REPSG
React Environmental
Professional Services Group, Inc.

October 6, 2008

Ms. Alizabeth Olhasso
PCB Compliance Officer
U.S. EPA Region 3
1650 Arch Street, Philadelphia, PA 19103

RE: Technical Project Briefing
Former Schmidts Brewery Site
Philadelphia, PA
REPSG Project Reference Number 6651.130.01

Ms. Olhasso,

The purpose of this document is to summarize a technical point on the former Schmidts Brewery Project ("Site"), as per your request. The investigation and remediation of the Site to date has been performed under the oversight of the Pennsylvania Department of Environmental Protection (PADEP) Land Recycling Program (LRP) established by the Pennsylvania Land Recycling and Environmental Remediation Standards Act ("Act 2"). The results of this investigation and remediation have been presented in the Combined Remedial Investigation Report and Cleanup Plan (Act 2 Combined Report) submitted to the PADEP on January 31, 2008 (which describes investigation and remediation of polychlorinated biphenyls (PCBs) as well as other compounds of concern). In a May 7, 2008 letter, PADEP concurred with the findings in the Act 2 Combined Report that soils remaining on-Site have attained Pennsylvania's Statewide Health Standard ("SHS") medium specific concentrations ("MSC") for *residential* exposure for sitewide soil and groundwater. This document presents further discussion of the soil SHS MSC.

Pennsylvania's soil SHS MSC is based on human health risk, as demonstrated below.

Technical Review of Pennsylvania Department of Environmental Protection (PADEP) Statewide Health Standard (SHS) Medium Specific Concentrations (MSC) for Soil

Section I and II- 250.305 Soil direct contact MSC derivation
Section III - 250.307 Inhalation Numeric Values
Section IV - 250.308 Soil to Groundwater pathway numeric values

I. Soil direct contact MSC derivation for use with attainment demonstration of the Statewide Health Standard.

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The MSCs are first limited to not exceed the physical capacity of the soil to contain a regulated substance. As the calculated limit for the PCB aroclors did not approach the physical capacity of the soil, no further discussion of this is presented herein.

For the residential standard, the MSC for each individual regulated aroclor in soil was calculated based on the lower of an ingestion or inhalation exposure model. In the case of the individually related PCB aroclors, the inhalation numeric value was the more stringent. Further discussion of the inhalation exposure model is presented below:

II 250.305 - MSCs

(ii) The inhalation numeric value throughout the soil column to a depth of up to 15 feet in soil from the existing ground surface, which considers volatilization into the outdoor air and inhalation of particulates, as determined by the methodology in § 250.307 (relating to inhalation numeric values), using the appropriate default residential exposure assumptions contained in § 250.307(d)

The inhalation value for the individually regulated PCB aroclors is based on the fact that they are not characterized as volatile and therefore are assumed to be attached to particles. The risk assumption assumes that PCBs are a carcinogen. Again, for the purposes of the Schmidts project, the residential exposure assumptions were utilized.

IV. 250.307 – Inhalation Numeric Values

(a) For a regulated substance which is a systemic toxicant, the following applies:
(1) For a volatile compound, the numeric value for inhalation from soil shall be calculated using the appropriate residential or nonresidential exposure assumptions from subsection (d) according to the following equation using TF for volatiles:

$$MSC = \frac{THQ \times RfD_i \times BW \times AT_{nc} \times 365\ days/yr \times TF}{Abs \times ET \times EF \times ED \times IR}$$

(2) For a regulated substance attached to particulates, the numeric value for inhalation from soil was calculated using the appropriate residential or nonresidential exposure assumptions from subsection (d) according to the equation in paragraph (1) using Transfer Factor (TF) for particulates.
(b) For a regulated substance which is a carcinogen, the following apply:
(1) For a volatile compound, the numeric value for inhalation from soil was calculated using the appropriate residential or nonresidential exposure assumptions from subsection (d) according to the following equation using TF for volatiles:

$$MSC = \frac{TR \times AT_c \times 365\ days/year \times TF}{CSF_i \times Abs \times ET \times EF \times If_{adj}}$$

(2) For a regulated substance attached to particulates, the numeric value for inhalation from soil was calculated using the appropriate residential or nonresidential exposure assumptions from subsection (d) according to the equation in paragraph (1) using transfer factor for particulates.

(c) For a regulated substance which is both a systemic toxicant and a carcinogen, the inhalation numeric value is the lower of the two numbers as calculated by the equations in subsections (a) and (b).

(d) The default exposure assumptions used to calculate the inhalation numeric values for soil are as follows:

		Residential		*Nonresidential*
Term		*Systemic*[1]	*Carcinogens*[2]	*(Onsite Worker)*
THQ	Target Hazard Quotient	1	N/A	1
RfD_i	Inhal. Reference Dose (mg/kg-day)	Chemical-specific	N/A	Chemical-specific
BW	Body Weight (kg)	70	N/A	70
AT_{nc}	Averaging Time for systemic toxicants (yr)	30	N/A	25
TF	Transport Factor (mg/kg)/(mg/m^3) Volatilization[3] Particulate[4]	Chemical-specific 1 x 10^{10}	Chemical-specific 1 x 10^{10}	Chemical-specific 1 x 10^{10}
Abs	Absorption (unitless)[5]	1	1	1
ET	Exposure Time (hr/day)	24	24	8
EF	Exposure Frequency[6] (d/yr)	250	250	180
ED	Exposure Duration (yr)	30	N/A	25
IR	Inhalation Rate (m^3/hr)	0.8[3]	N/A	1.25
TR	Target Risk	N/A	1 x 10^{-5}	1 x 10^{-5}
CSF_i	Inhalation Cancer Slope Factor (mg/kg-day)$^{-1}$	N/A	Chemical-specific	Chemical-specific
AT_c	Averaging Time for carcinogens (yr)	N/A	70	70
If_{adj}	Inhalation Factor[7] (m^3-yr/kg-hr)	N/A	0.5	0.4

Notes: Modified from USEPA Region III Risk-based Concentration Table, dated October 20, 1995.
N/A = Not Applicable
[1]Residential exposure to systemic toxicants is based on adult exposure, consistent with USEPA (1991).
[2]Residential exposure to carcinogens is based on combined child and adult exposure.
[3]Volatilization transport factor is calculated using TF = (ER x DF)$^{-1}$, where DF = 12 (mg/m^3)/(m^2-sec). See soil depth-specific algorithm for the calculation of ER.
[4]Particulate transfer factor was calculated using TF = (ER x DF)$^{-1}$, where ER = 8.25 x 10^{-12} (mg/m^2-sec)/(mg/kg) and DF = 12(mg/m^3)/(mg/m^2-sec).
[5]In cases where the inhalation RfD or CSF is based on absorbed dose, this factor can be applied in the exposure algorithm. The default value is 1.
[6]Assumes approximately 100 days/yr with the ground being frozen. Exposure to surficial soils when the ground is frozen is considered *de minimis*. The nonresidential exposure frequency is defined as 5/7 x 250 days/yr.
[7]The inhalation factor for the residential scenario is calculated using the equation $IF_{adj} = ED_c \times IR_c/BW_c + ED_a \times IR_a/Bw_a$, where ED_c = 6 yr, IR_c = 0.5 m^3/hr, BW_c = 15kg, ED_a = 24 yr, IR_a = 0.83 m^3/hr, and BW_a = 70 kg. The inhalation factor for the nonresidential scenario is calculated using the equation IF_{adj} = ED x IR/BW, where ED = 25 yr, IR = 1.25 m^3/hr and BW = 70 kg.

(e) For the inhalation numeric values in subsections (a) and (b), the TF was calculated by the following equation:

$TF = (ER \times DF)^{-1}$

The Dispersion Factor (DF) value of 12 $(mg/m^3)/(mg/m^2/sec)$ is taken from the default value in the EPA Draft Soil Screening Guidance (U. S. EPA, 1994. *Technical Background Document for Soil Screening Guidance*. Review Draft. Office of Emergency and Remedial Response. EPA-540/R-94/106) and the Emission Rate (ER) is calculated by the following equations (from Jury et al. 1990. *Water Resources Research*, Vol. 26. No. 1. pp. 13-20):

$$ER = \frac{1}{T}\int_0^T \left(\frac{C_o}{C_S}\right)(D_E/\pi t)^{0.5}\left[1 - \exp^{(-L^2/(4D_E t))}\right] \bullet (10^3)\, dt$$

$$D_E = \frac{D_G}{\frac{\rho_b K_d}{H} + \frac{\theta_m}{H} + \theta_a} + \frac{D_L}{\rho_b K_d + \theta_m + \theta_a H}$$

where:

$$D_G = \left(\frac{\theta_a^{10/3}}{\theta^2}\right) D_{ai}$$

$$D_L = \left(\frac{\theta_m^{10/3}}{\theta^2}\right) D_{Li}$$

(ii) For subsurface soils:

$$ER = \frac{1}{T}\int_0^T \left(\frac{C_o}{C_S}\right)(D_E/\pi t)^{0.5}\left[\exp^{(-L^2/4D_E t)} - \exp^{(-(L+W)^2/(4D_E t))}\right] \bullet (10^3)\, dt$$

$$D_E = \frac{D_G}{\frac{\rho_b K_d}{H} + \frac{\theta_m}{H} + \theta_a} + \frac{D_L}{\rho_b K_d + \theta_m + \theta_a H}$$

where:

$$D_G = \left(\frac{\theta_a^{10/3}}{\theta^2}\right) D_{ai}$$

$$D_L = \left(\frac{\theta_m^{10/3}}{\theta^2}\right) D_{Li}$$

Parameter	*Definition*	*Unit*	*Recommended Value[1]*
ER	Chemical vapor emission rate from surface soil or subsurface soil	mg/m^2-sec per mg/kg	Chemical-specific
C_o	Chemical concentration in soil, $C_o = C_S[\text{rho}]_b$	g/m^3	1.8
C_S	Chemical concentration in soil	mg/kg (ppm)	1
D_E	Effective diffusion coefficient	m^2/sec	Chemical-specific
D_{ai}	Air diffusivity for chemical i	m^2/sec	Chemical-specific
D_{Li}	Water diffusivity for chemical i	m^2/sec	Chemical-specific
t	Time	sec	N/A
T	Emission averaging time	sec	Equal to exposure

			duration
[thgr]	Total soil porosity, [thgr] = [thgr]$_a$ + [thgr]$_m$	cm^3/cm^3	0.32[2]
[thgr]$_a$	Air-filled soil porosity	cm^3/cm^3	0.12[2]
[thgr]$_m$	Moisture-filled soil porosity, [thgr]$_m$ = w[rho]$_b$	cm^3/cm^3	0.20[2]
w	Moisture content for soil	g water/g soil	0.11
[rho]$_b$	Dry bulk density of soil, [rho]$_b$ = (1-[thgr]) [rho]	g/cm^3	1.8[2]
[rho]	Soil particle density	g/cm^3	2.65
K_d	Partition coefficient, $K_d = K_{oc}f_{oc}$	cm^3/g	Chemical-specific
H	Henry's Law constant	dimensionless	Chemical-specific
D_G	Effective gas-phase diffusion coefficient	m^2/sec	Chemical-specific
D_L	effective liquid-phase diffusion coefficient	m^2/sec	Chemical-specific
L	Depth of the contaminated surface soil	m	0.6[3]
l	Depth of the clean soil cover	m	0.6[3]
W	Thickness of the contaminated subsurface soil	m	4.0[3]
K_{OC}	Organic carbon partition coefficient for chemical i	cm^3/g	Chemical-specific
f_{OC}	Fraction of organic carbon in soil	dimensionless	0.005[4]

[1]All default values from USEPA (1994) Draft Soil Screening Guidance, EPA-540/R-94/106, except as noted.
[2]Consistent with Standards Subcommittee recommendation.
[3]Based on Act 2 SAB-agreed depths.
[4]The Risk Assessment Subcommittee selected a f_{oc} of 0.005, which falls between f_{oc}'s of 0.006 for surface soil and 0.002 for subsurface soil.

Please do not hesitate to contact us if you have further questions or if we can provide further clarification.

Sincerely,

Jenny Cutright
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